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Using online quizzing and quiz results to improve study success.

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INVITED SYMPOSIUM SIG-DT, THEME: TEST-ENHANCED LEARNING MEETS LEARNING ANALYTICS.

USING ONLINE QUIZZING AND QUIZ RESULTS TO IMPROVE
STUDY SUCCESS

SILVESTER DRAAIJER
VRIJE UNIVERSITEIT AMSTERDAM

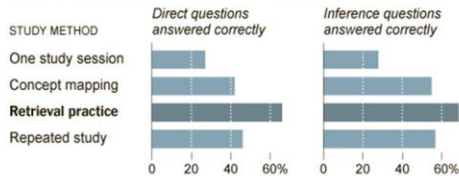


ONLINE QUIZZING

Perfect for data-collection of learning activity and acting on it!

LEARNING THROUGH TESTING – TESTING EFFECT

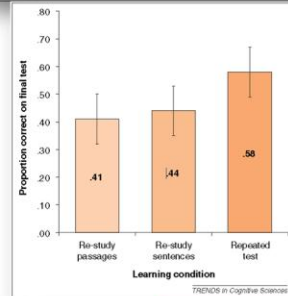
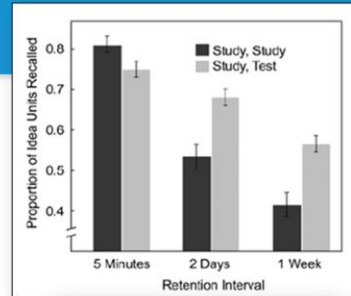
Researchers asked college students to study a short science text using one of four study methods, then tested them a week later. The most effective study method combined two study sessions with retrieval practice, tests that asked the students to recall what they had read.



Mcdaniel, M. A. et al. (2007)
 Karpicke, J. D., & Roediger, H. L. (2008),
 Roediger, H. L. I., & Karpicke, J. D. (2006)

Recall test (Short Answer) have stronger effects than recognition tests (MCQ).

E-assessment by design, Nicol, D (2007)



Roediger, H. L., & Karpicke, J. D. (2006). Test-Enhanced Learning. *Psychological Science*, 17(3), 249–255. doi:10.1111/j.1467-9280.2006.01693.x (image also from that article)

Larsen, D. P., Butler, A. C., & Roediger III, H. L. (2009). Repeated testing improves long-term retention relative to repeated study: a randomised controlled trial. *Medical Education*, 43(12), 1174–1181. doi:10.1111/j.1365-2923.2009.03518.x

Gates, A. I. (1917). Recitation as a factor in memorizing. *Archives of Psychology*, 6, No. 40.

Karpicke, J. D., & Roediger, H. L. (2008). The Critical Importance of Retrieval for Learning. *Science*, 319(5865), 966–968. doi:10.1126/science.1152408

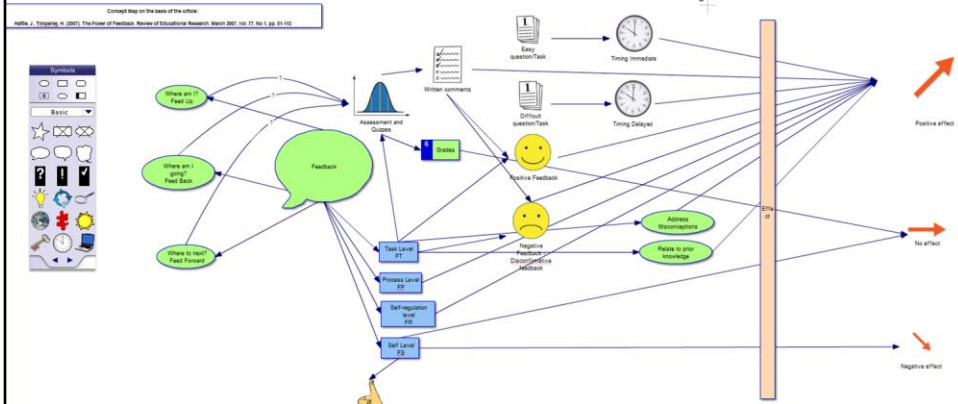
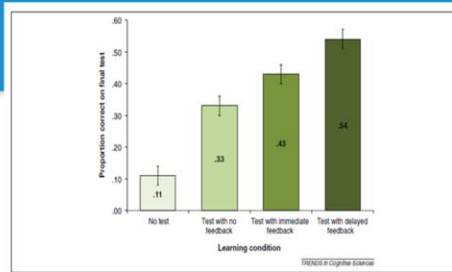
Roediger, H. L. I., & Karpicke, J. D. (2006). The Power of Testing Memory. *Basic Research and Implications for Educational Practice*. Association for Psychological Science, 1(3), 181–210.

Mcdaniel, M. A., Roediger, H. L., & Mcdermott, K. B. (2007). Generalizing test-enhanced learning from the laboratory to the classroom. *Psychonomic Bulletin & Review*, 14(2), 200–206. doi:10.3758/BF03194052

Nicol, D. (2007). E-assessment by design: using multiple-choice tests to good effect. *Journal of Further and Higher Education*, 31(1), 53–64. doi:10.1080/03098770601167922

Johnson, M. T. (2008). Impact of Online Learning Modules on Medical Student Microbiology Examination Scores. *Journal of Microbiology & Biology Education*, 9(1). doi:10.1128/jmbe.v9.91

FEEDBACK



Butler, A. C., & Roediger, H. L. (2008). Feedback enhances the positive effects and reduces the negative effects of multiple-choice testing. *Memory & Cognition*, 36(3), 604-616. doi:10.3758/MC.36.3.604

Roediger III, H. L., & Marsh, E. J. (2005). The positive and negative consequences of multiple-choice testing. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 31(5), 1155.

Hattie, J., & Timperley, H. (2007). The Power of Feedback. *Review of Educational Research*, 77(1), 81–112. doi:10.3102/003465430298487

CORRELATIONAL EFFECTS QUIZZING ON EXAM SCORES

- > Correlation between participation rate and exam scores
 - > High correlation: Kibble and others (2007, 2008, 2011)
- > Correlation between quiz promotion and participation
 - > Andrews, T. M., et al. (2011), Kibble, J.D. (2011)
- > Correlation between credit given and participation
 - > Kibble, J.D. (2011)



Mcdaniel, M. A., Roediger, H. L., & Mcdermott, K. B. (2007). Generalizing test-enhanced learning from the laboratory to the classroom. *Psychonomic Bulletin & Review*, 14(2), 200–206. doi:10.3758/BF03194052

Kibble, J. (2007). Use of unsupervised online quizzes as formative assessment in a medical physiology course: effects of incentives on student participation and performance. *Advances in Physiology Education*, 31(3), 253–260.

Kibble, J. D., Johnson, T. R., Khalil, M. K., Nelson, L. D., Riggs, G. H., Borrero, J. L., & Payer, A. F. (2011). Insights Gained from the Analysis of Performance and Participation in Online Formative Assessment. *Teaching and Learning in Medicine*, 23(2), 125–129. doi:10.1080/10401334.2011.561687

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Andrews, T. M., Leonard, M. J., Colgrove, C. A., & Kalinowski, S. T. (2011). Active Learning Not Associated with Student Learning in a Random Sample of College Biology Courses. *CBE-Life Sciences Education*, 10(4), 394–405. doi:10.1187/cbe.11-07-0061

Kibble, J. D. (2011). Voluntary participation in online formative quizzes is a sensitive predictor of student success. *Advances in Physiology Education*, 35(1), 95–96. doi:10.1152/advan.00053.2010

VARIATIONS

- > Distributed Learning – Spacing Effect
 - > Ebbinghaus (1885)!
 - > Kerfoot et al. (2007, 2009, 2010)
- > Collaborative Testing
 - > Giuliodori, M. J., (2008), Kapitanoff, S. H. (2009), Rao, S. P., et al. (2002), Slusser, S. R., & Erickson, R. J. (2006).
- > Question generation by students
 - > Denny, P., Hanks, B., & Simon, B. (2010), Fellenz, M. R. (2004).
- > Lecture Clickers and other Response Systems
 - > For example Mazur, E., & Crouch, C. H. (2001), Caldwell (2007), Draper (2009) - Catalytic assessment
- > Question Formats
 - > Various MCQ formats
 - > Short Answer formats



Ebbinghaus, Hermann (1885) (in German). Über das Gedächtnis. Untersuchungen zur experimentellen Psychologie [Memory: A Contribution to Experimental Psychology]. Trans. Henry A. Ruger & Clara E. Bussenius. Leipzig, Germany: Duncker & Humblot.

Kerfoot, B. P. (2009). Learning benefits of on-line spaced education persist for 2 years. *The Journal of Urology*, 181(6), 2671–2673. doi:10.1016/j.juro.2009.02.024

Kerfoot, B. P., DeWolf, W. C., Masser, B. A., Church, P. A., & Federman, D. D. (2007). Spaced education improves the retention of clinical knowledge by medical students: a randomized controlled trial. *Medical Education*, 41(1), 23–31. doi:10.1111/j.1365-2929.2006.02644.x

Kerfoot, B. P., Fu, Y., Baker, H., Connelly, D., Ritchey, M. L., & Genega, E. M. (2010). Online spaced education generates transfer and improves long-term retention of diagnostic skills: a randomized controlled trial. *Journal of the American College of Surgeons*, 211(3), 331–337.e1. doi:10.1016/j.jamcollsurg.2010.04.023

Kerfoot, B. P., Kearney, M. C., Connelly, D., & Ritchey, M. L. (2009). Interactive spaced education to assess and improve knowledge of clinical practice guidelines: a randomized controlled trial. *Annals of Surgery*, 249(5), 744–749. doi:10.1097/SLA.0b013e31819f6db8

Giuliodori, M. J., Lujan, H. L., & DiCarlo, S. E. (2008). Collaborative group testing benefits high- and low-performing students. *Advances in Physiology Education*, 32(4), 274–278. doi:10.1152/advan.00101.2007

Kapitanoff, S. H. (2009). Collaborative testing. *Active Learning in Higher Education*, 10(1), 56–70.

Rao, S. P., Collins, H. L., & DiCarlo, S. E. (2002). Collaborative testing enhances student learning. *Advances in Physiology Education*, 26(1), 37–41.

Slusser, S. R., & Erickson, R. J. (2006). Group Quizzes: An Extension of the Collaborative Learning Process. *Teaching Sociology*, 34(3), 249–262. doi:10.1177/0092055X0603400304

Denny, P., Hanks, B., & Simon, B. (2010). Peerwise: replication study of a student-collaborative self-testing web service in a u.s. setting. *Proceedings of the 41st ACM technical symposium on Computer science education, SIGCSE '10* (pp. 421–425). New York, NY, USA: ACM. doi:10.1145/1734263.1734407

Fellenz, M. R. (2004). Using assessment to support higher level learning: the multiple choice item development assignment. *Assessment & Evaluation in Higher Education*, 29(6), 703–719.

Mazur, E., & Crouch, C. H. (2001). Peer Instruction: Ten Years of Experience and Results. *American Journal of Physics*, 69(9), 970–977.

Caldwell, J. E. (2007). Clickers in the large classroom: current research and best-practice tips. *CBE-Life Sciences Education*, 6(1), 9–20.

Draper, S. W. (2009). Catalytic assessment: understanding how MCQs and EVS can foster deep learning. *British Journal of Educational Technology*, 40(2), 285–293. doi:10.1111/j.1467-8535.2008.00920.x

Answer Until Correct (AUC) – test-taker selects answer, then receives feedback if correct or not, if not → test-takers selects next answer

etc.: <http://www.epsteineducation.com/home/about/how.aspx>

Discrete Option Multiple Choice (DOMC) – test-taker is only shown one answering option of an mc question at a time, student must select correct answer when it is displayed: <http://go.gal/fab6r>

Certainty Based Marking (CBM) – test-taker must provide certainty level of being correct for each option in an mc question: <http://www.ucl.ac.uk/lapt/index.htm>

NEW! Confidence Based Marking – seems an interesting variant of Certainty Based Marking (but uses the old term of Gardner-Medwin for it unfortunately) – first, the test-takers only see the stimulus, then rates confidence of being able to answer correctly, then is presented all options and then selects the correct option: <http://go.gal/fab6r>

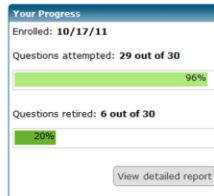
Number right elimination testing (NRET) – a variant of elimination testing (ET) – mark incorrect answers, mark correct answer and provide certainty level for it: http://www.ifets.info/journals/14_4/10.pdf

Liberal (Free-Choice) Multiple-Choice Tests – test-taker may select any option of an mc question but correct option is awarded 3 points, any incorrect selected option is awarded -1 point. Main idea: System discourages guessing: <http://pareonline.net/pdf/v11n8.pdf>, try it at <https://quizslides.com/#0/6>

Jordan, S., & Mitchell, T. (2009). e-Assessment for learning? The potential of short-answer free-text questions with tailored feedback. *British Journal of Educational Technology*, 40(2), 371–385.

ANALYTICS – ACTING ON THE DATA

- > Selection and timing of questions to answer
 - > Repeated practice
 - > Within minutes/hours/days/weeks/months?
 - > Drop-off rate of successfully recalled answers



Rules of the Game

Questions per delivery: 2

Frequency of delivery (days): 1

Questions **incorrectly** answered are repeated after (days): 8

Questions **correctly** answered are repeated after (days): 20

Number of consecutive correct answers to retire a question: 2

[Update](#)

http://ondemand.blackboard.com/r91/movies/Bb91_evaluation_sending_notifications.htm

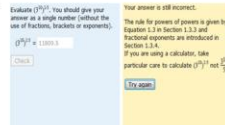
Images: <http://qstream.com>

ANALYTICS – ACTING ON THE DATA

> Timing of feedback – Based on Correct-Incorrectness and Speed

> Per question

> Answer again



> Per group of questions

> Per test as a whole

> Directly after, longer and even longer

Feedback

Feedback Authoring

- ☒ Question-Level Feedback
- ☐ Selection-Level (A,B,C...) Feedback
- ☐ Both

Feedback Delivery

- ☐ Immediate Feedback
- ☒ Feedback on submission
- ☐ No Feedback will be displayed to the student
- ☐ Feedback will be displayed to the student at a specific date

[OK]

(Selecting "Grades sent to Gradebook" in Grading section will send scores to Gradebook immediately, regardless of feedback date.)

☐ Only Release Student's Assessment Scores (questions not shown)

☒ Release Questions and the following

<input checked="" type="checkbox"/> Student Response	<input checked="" type="checkbox"/> Question-Level Feedback
<input checked="" type="checkbox"/> Correct Response	<input checked="" type="checkbox"/> Selection-Level Feedback

Image from Assessment Feedback Settings Sakai CLE

Image from Sally Jordan Blog: <http://www.open.ac.uk/blogs/SallyJordan/?p=880>

ANALYTICS – ACTING ON THE DATA

Performance Dashboard

The Performance Dashboard provides an up-to-date report on the activity for all students. Information appears in a table format. Click the arrow in the header row of a column to sort the table data by that column. [More Help](#)

Last Name	First Name	Username	Role	Last Course Access	Days Since Last Course Access	Review Status	Adaptive Release	Discussion Board	Early Warning System	View Grades
Brown	Tony	tbrown	Student	Sep 6, 2011 4:41:54 PM	71	1		2	0/2	
Casper	Chris	ccasper	Student	Sep 29, 2011 50 2:16:41 PM	50	1		2	0/2	
Chu	Cathy	cchu	Instructor	Nov 18, 2011 0 5:37:28 PM	0	0		2	0/2	
Cooper	Ashby	acooper	Student	Mar 23, 2010 605 6:03:01 PM	605	1		1	0/2	
Durand	Porter	pdurand	Student	Mar 23, 2010 605 1:02:43 PM	605	1		1	0/2	
Gonzales	Monica	mgonzales	Teaching Assistant	Mar 21, 2010 607 3:40:09 PM	607	0		0	0/2	
Herrera	Linda	lherrera	Student	Mar 23, 2010 605 12:56:45 PM	605	1		2	0/2	
Johnson	Ryan	rjohnson	Student	Mar 26, 2010 602 8:33:27 AM	602	1		5	0/2	
Lopez	Bruce	blopez	Student	Mar 23, 2010 605 6:48:31 PM	605	1		1	1/2	
Perez	Javier	jperez	Student	Mar 23, 2010 605 7:01:21 PM	605	1		4	1/2	

http://ondemand.blackboard.com/r91/movies/Bb91_evaluation_sending_notifications.htm

ANALYTICS

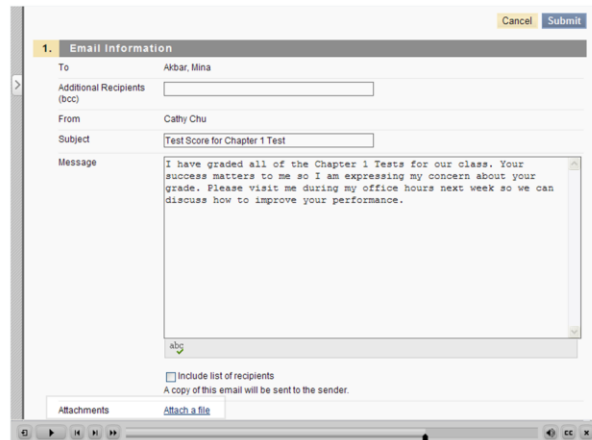
The screenshot displays the Blackboard Early Warning System interface. At the top, a green banner states: "Rules have been successfully refreshed. If edited results are not reflected on the page, reload the page." Below this, the title "Early Warning System" is shown with a "Create Rule" button and "Search" and "Notification History" links. A table lists the rules, with one rule selected:

Available	Name	Type	Criteria	Number of Warnings	Last Refresh
<input type="checkbox"/>	Yes	Test Score	Grade Chapter 1 Test - Score less than or equal to 75	16/29	Aug 16, 2010 2:10 AM

Below the table, it says "Displaying 1 to 1 of 1 items" with "Show All" and "Edit Paging" links. The interface includes standard Blackboard navigation elements like "Introduction to Oceanography" and "Evaluation" in the top bar, and a "VU" logo in the bottom right corner.

http://ondemand.blackboard.com/r91/movies/Bb91_evaluation_sending_notifications.htm

ANALYTICS



The screenshot shows a web-based email composition interface. At the top right are 'Cancel' and 'Submit' buttons. The main section is titled '1. Email Information'. It contains the following fields:

- To:** Akbar, Mina
- Additional Recipients (bcc):** An empty text input field.
- From:** Cathy Chu
- Subject:** Test Score for Chapter 1 Test
- Message:** A large text area containing the message: "I have graded all of the Chapter 1 Tests for our class. Your success matters to me so I am expressing my concern about your grade. Please visit me during my office hours next week so we can discuss how to improve your performance." Below the text area is a small 'abc' icon with a checkmark.
- Attachments:** A section with an 'Attach a file' link.

At the bottom of the message area, there is a checkbox labeled 'Include list of recipients' and a note: 'A copy of this email will be sent to the sender.'

http://ondemand.blackboard.com/r91/movies/Bb91_evaluation_sending_notifications.htm

CONCLUSION

- > Assessment in the form of quizzing can be powerful learning aid
- > Analytics can help with
 - > Promotion of use
 - > Decisions for repetition
 - > Timing of repetition
 - > Timing and type of feedback
- > Two more presentations to go:
 - > Sharon Klinkenberg, Universiteit van Amsterdam
 - > Caroline Timmers, Universiteit Twente

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